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MONITORING OF CONE AND SEED INSECT DAMAGE TO LOBLOLLY PINE AT THE STUART ORCHARD, POLLOCK, LOUISIANA

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MONITORING OF CONE AND SEED INSECT DAMAGE TO LOBLOLLY PINE AT THE STUART ORCHARD, POLLOCK, LOUISIANA

(1975-78)

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ABSTRACT

Evaluations were conducted at the Stuart Federal Seed Orchard, Pollock, Louisiana on Loblolly pines Pinus taeda L. 1975-78 to monitor insect caused damage, assess operational effectiveness of insect control, gain information on timing insecticide applications and prepare biological and post-suppression evaluations. Most of the losses to conelets and cones were due to coneworms or unknown causes. Over all, very small increases in yield were obtained from the azinphosmethyl (Guthion®) treatments. The primary reason for this was that 53 percent of the damage occurred before the first insecticide application in May. Although the February 1977 carbofuran (Furadan®) treatment almost doubled cone production over the check the second year after treatment (October 1978) the loblolly cone crop on treated areas was still so light that it was not harvested. Despite the low increase in seed yield obtained during the period of the evaluation, it was felt that insecticide treatments should be continued to prevent excessive cone and seed losses during years of high insect activity. Insect damage peaked in April, June, and September; therefore, the best times for applying azinphosmethyl would be just prior to these peaks in late March, late May and late August or early September.

INTRODUCTION

In recent years, production of superior seed from pine seed orchards has become increasingly important because of the potential increased quality and the quantity of timber expected to be produced. Therefore, tree improvement foresters are interested in obtaining maximum production of improved seed. Often losses exceed 80 percent of the potential seed

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crop. However, the extent of damage to cones and seed, the agents causing damage, and the time period losses are occurring are often not known. Monitoring of cone losses is needed to determine need for and effectiveness of insect control efforts.

Several investigators have assessed losses to loblolly Pinus taedae L. cones and seeds (Goyer and Nachod 1976; Fatzinger et al 1980; Yates and Ebel 1978). These investigators generally found that conelet losses were abortions for unknown reasons and cone losses were caused mainly by coneworms, Dioryctria spp. DeBarr (1974) found that seedbugs caused extensive loblolly pine conelet and seed mortality in Georgia.

In order to monitor the causal agents damaging conelets, cones, seeds and vegetative shoots and develop a cone life table, evaluations were conducted at the Stuart Federal Seed Orchard, Pollock, Louisiana from 1975-76. Information from these evaluations was used for, (1) monitoring insect-caused damage, (2) evaluating operational effectiveness of selected insecticides,(3) timing future insecticide applications and (4) preparing biological and post-suppression evaluations.

METHODS

In 1975, 10 percent of the conelets and 10 percent of the cones of three ramets of each of four clones were tagged on the Louisiana loblolly seed source in each an untreated area, heavily fertilized area (600# 12-12-12), and an area sprayed with dimethoate four times (Fig. 1). Both the untreated and sprayed areas were treated with 200# of 12-12-12 fertilizer. Conelets and cones were visually examined for insect damage monthly (March, 1975 through October, 1976). The trees are planted at a spacing of 30' x 30'.

In 1977, two ramets of each of four clones were tagged as above, in each an area treated with carbofuran applied by hand shaker, an area treated with carbofuran by fertilizer spreader and a check area (Fig. 1). Tagged conelets and cones were examined for insect damage monthly in 1977 and once in October, 1978. Five branches containing cone clusters were caged with aluminum screen (.05 mesh) in March, 1976 to prevent insect attack.

All mature cones were picked from each sample ramet each year and examined for coneworm damage. Six cones were sampled from each sample ramet from 1976-1978. In addition six cones were collected from caged cones on check trees in 1976. Cones sampled in 1975 and 1976 were subjected to CAS[4/] analysis and cones sampled in 1977 and 1978 were subjected to SOSET[5/] analysis.

The 20 top most tips were examined for Nantucket pine tip moth (Rhyacionia frustrana Comstock) damage on all sample ramets in October, 1975 and 1976.

Treatments used are summarized in Table 1.

4/ This is a comprehensive analysis of the status of each potential seed, including first and second year abortions, sound seeds, malformed seeds, empty seeds, insect damaged seeds and germination.

5/ This is an evaluation of a random sample of 100 seeds that shake loose from a bulk sample of 20 to 50 cones. It provides an x-ray analysis showing percent seedbug damaged, percent seedworm damaged and percent malformed seed.

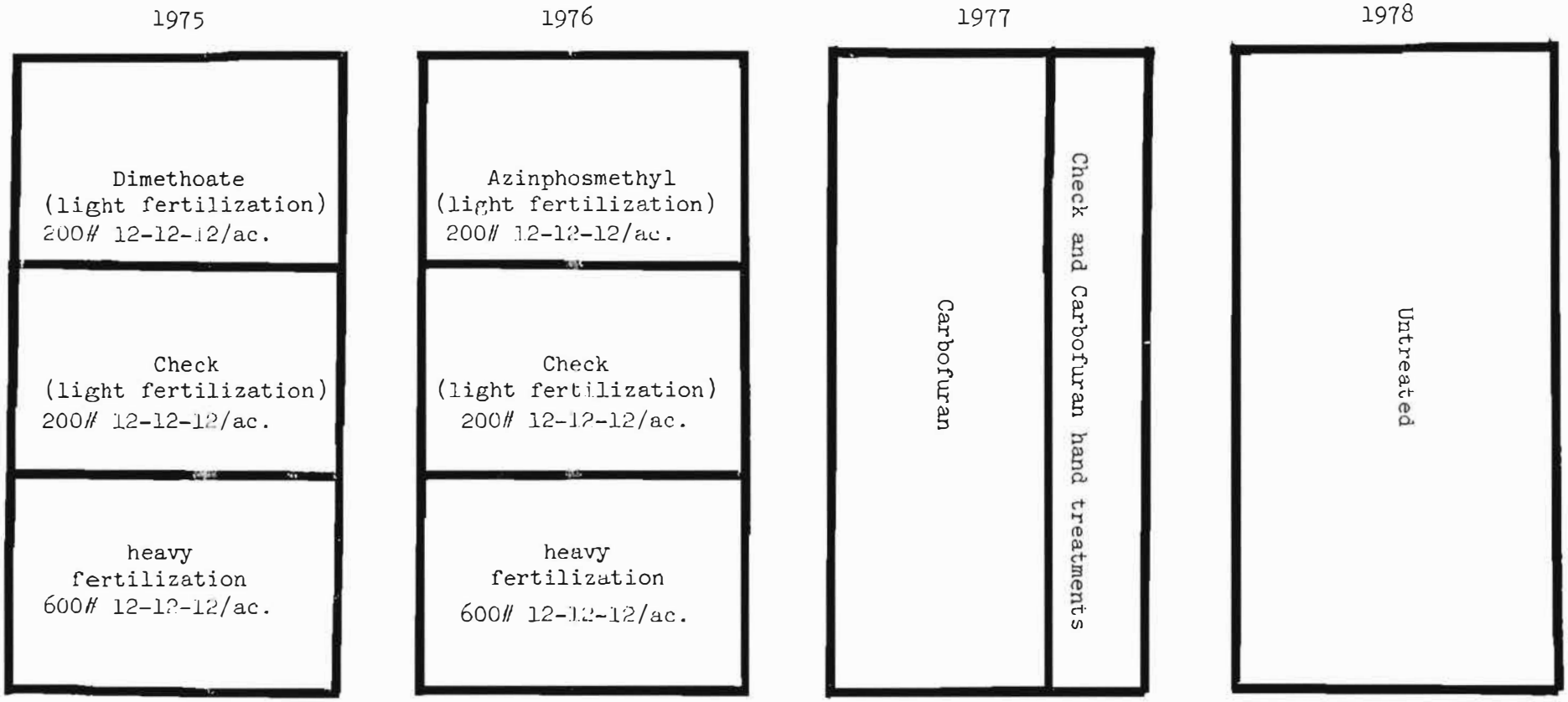

Figure 1. Diagram showing relative location of treatment plots on the Louisiana loblolly seed source at Stuart Seed Orchard 1975-78.

Table 1. Treatments at Stuart Orchard on the Louisiana Loblolly Pine Seed Source (1975-1978)

Year	Treatment[1/]	Rate	Equipment	Months
1975	Dimethoate (Cygon 2E)	5 ml/liter H_2O (4 pts/100 gal.)	Myers Sprayer (mist blower) 2 gal/tree	May, June July, August
1976	Azinphosmethyl (Guthion 2S)	20 ml/liter H_2O (16 pts/100 gal.)	Myers Sprayer (mist blower) 2 gal/tree	April, May June, July
1977	Carbofuran (Furadan 10G)	45 g/cm dbh (4 oz/in.)	Tractor mounted Fertilizer Spreader and disked 3" deep	February
	Carbofuran (Furadan 10G)	45 g/cm dbh (4 oz/in.)	Hand application trunk to drip line of tree and covered with mulch	February
1973-1976	heavy fertilization with 12-12-12	109.3 kg/ha (600#/ac)	Fertilizer Spreader	February

1/ All treatment plots except the heavy fertilization received 200#/acre of 12-12-12 fertilizer.

Design and Statistical Analysis

A randomized block design was used for the evaluation with clones equal to blocks. The data were evaluated by analysis of variance and Duncan's multiple range procedures. The factors were treatments, clones, and ramets. Ramets were nested within clones. Treatments were crossed with each clone/ramet combination.

The following response variables were analyzed as above for each year of the evaluation:

1. Tips damaged by tip moth
2. Conelets and cones (monthly observations totaled)
   a. percent tip moth losses
   b. percent coneworm losses
   c. percent unknown losses
   d. percent other losses
   e. percent total losses
   f. percent healthy
3. Seed
   a. percent full seed
   b. number of full seeds/cone
   c. percent empty seed
   d. percent seedbug damage
   e. percent seedworm damage

RESULTS

Conelet Losses

No significant difference between treatments (spray, fertilization, or check) for total conelet losses occurred during 1975 or 1976 (Table 2). The carbofuran treatment (31 percent loss) was significantly less than the check (57 percent loss) for total conelet loss in 1977.

The heavy fertilization treatment had significantly less identifiable coneworm damage than the dimethoate treatment or the check treatment in 1975. However, this treatment did not show a significant difference from the check in 1976. The azinphosmethyl treatment was significantly better than the heavy fertilization and check treatments for coneworm damage in 1976. The carbofuran treatment was significantly better than the check for coneworm damage in 1977.

Conelet losses due to tip moths were light with no significant differences occurring for any treatments during 1975 and 1976.

Mature Cone Losses

As far as cone loss at harvest, there was no significant difference among treatments for any of the variables analyzed for any of the years of the evaluation (Table 3).

Table 2. Percent conelet losses on loblolly pines at the Stuart Seed Orchard, Pollock, La. 1975-1977[1/]

Flower Year	Treatment[2/]	Tip Moth	Coneworm	Unknown	Total Loss
1975	Dimethoate	2a[3/]	15a	48a	65a
	Heavy fertilization	4a	3b	29a	41a
	Check	2a	15a	28a	50a
1976	Azinphosmethyl	0	0a	42a	42a
	Heavy fertilization	0	6b	40a	47a
	Check	0	7b	35a	42a
1977	Carbofuran	-	10a	21	31a
	Check	-	23b	34b	57b

1/ Based on 10 percent of the conelets tagged on three ramets x four clones on the Louisiana loblolly seed source.

2/ For treatment dosage rates and schedules see Table 1.

3/ Means not followed by the same letter are significantly different from one another at the 5 percent level of significance.

Table 3. Percent of mature cone losses on loblolly pines at Stuart Seed Orchard, Pollock, La. 1975-1978[1/]

Cone Year	Treatment[2/]	Coneworm	Unknown	Total losses
1976	Azinphosmethyl	6a[3/]	0a	6a
	Heavy fertilization	7a	2a	10a
	Check	9a	2a	11a
1977	Carbofuran	8a	1a	9a
	Check	24a	3a	27a
1978	Carbofuran	27a	-	27a
	Check	46a	-	46a

1/ Based on 10 percent of the cones tagged on three ramets of each of four clones.

2/ For treatment dosage rates and schedules see Table 1.

3/ Means not followed by the same letter are significantly different from one another at the 5 percent level of significance.

Conelet to Mature Cone Losses for 2 Year Periods

Where losses (conelet to cone) were assessed monthly for 2-year periods, coneworm losses were significantly less in the azinphosmethyl treatment than in the other two treatments in 1975-76 (Table 4). However, there was no significant difference among treatments for percent total loss. The unknown and total loss categories were significantly less for the carbofuran treatment than the check in 1977-78.

Peak Periods of Conelet and Cone Damage

Data for untreated checks showed total damage (all causes) for the life cycle of the cones (1975-76) peaking in early May 1975 (Fig. 2). Approximately 53 percent of the damage that occurred during the 20 month life cycle of the cones occurred by May before insecticide had been applied. Approximately 78 percent of the total mortality to the crop occurred in the first year of development.

Coneworm damage in the check treatment showed four small peaks during the 20 month life cycle of the cones (1975-76) (3.3 percent to conelets in June 1975, 2.4 percent to conelets in September 1975, 2.0 percent to cones in May 1976, and 3.9 percent to cones in September 1976). About one-half of the coneworm damage occurred the first year of conelet development and one-half the second year (cone development) for a total of 19 percent coneworm losses for the 2-year period.

Vegetative Tips

The fertilization treatment (91 percent healthy tips) in September 1975 showed significantly more healthy tips than the dimethoate (61 percent) or check (68 percent) treatments (Table 5). The dimethoate treatment showed no significant difference in protecting tips over the untreated trees in 1975. One reason was that the first generation of tip moth in March and April was not sprayed. In 1976, the azinphosmethyl treatment had significantly more healthy tips (98 percent) than either the heavy fertilization (83 percent) or check (87 percent) treatments.

Seeds

In 1976, the heavy fertilization treatment had significantly fewer percent full seed (32 percent) than the untreated (62 percent) or insecticide treatment (77 percent) (Table 6). The variable, full seeds per cone for the heavy fertilization treatment was not significantly different from the check but both the heavy fertilization and check treatments had significantly fewer full seeds per cone than the azinphosmethyl treatment. In 1976 the azinphosmethyl treatment had significantly fewer empty seeds than either the heavy fertilization or check treatments. No significant difference among treatments for percent empty seed occurred in 1977 or 1978.

For 1977, percent full seed and percent empty seed categories showed no significant difference between treatments. However, the carbofuran disk treatment, the carbofuran hand treatment and the caged checks were significantly better than the uncaged check for numbers of sound seeds per cone.

Table 4. Conelet and cone losses on loblolly pines at Stuart Orchard, Pollock, La. for 2-year periods, 1975-76, 1977-78[1/]

Years	Treatment[2/]	Tip Moth	Coneworm	Unknown	% Total loss
1975-76	Check	2a[3/]	19a	48a	69a
	Dimethoate '75, Azinphosmethyl '76	4a	6b	31a	44a
	Heavy fertilization	2a	18a	28a	54a
1977-78	Carbofuran	0	31a	13a	44a
	Check	0	43a	40b	83b

1/ Based on 10 percent of the conelets tagged in February and examined monthly for a 20-month period.

2/ For treatment dosage rates and schedules see Table 1.

3/ Means not followed by the same letter are significant from one another at the 5 percent level of significance.

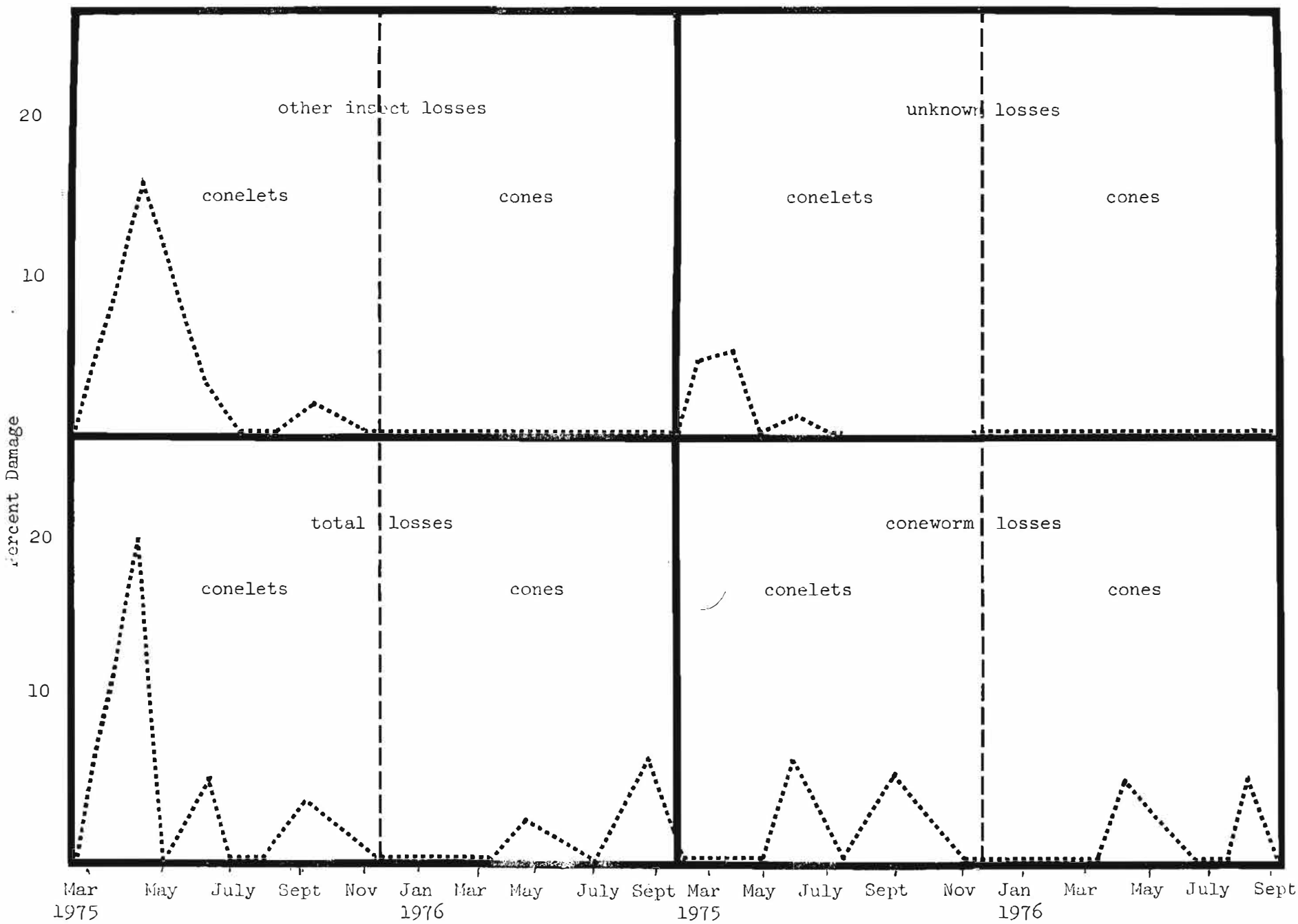

Figure 2. Conelet and cone losses on untreated loblolly pines at Stuart Orchard, Pollock, La. 1975-76.

Table 5. Vegetative tip losses due to tip moths infesting loblolly pines at Stuart Orchard, Pollock, La. 1975-76.

Year	Treatment[2/]	Percent healthy tips[1/]
1975	Dimethoate	61a[3/]
	Fertilization	91b
	Check	68a
1976	Azinphosmethyl	98a
	Heavy Fertilization	83b
	Check	87b

1/ Based on examination of 20 topmost tips on two ramets of each of two clones in each treatment.

2/ For treatment dosage rates and schedules see Table 1.

3/ Means not followed by the same letter are significantly different from one another at the 5 percent level of significance.

Table 6. Seed losses on Louisiana loblolly pines at Stuart Orchard, Pollock, La. 1976-78[1/]

Year	Treatment	Percent full seed	Full seed/cone	Percent empty seed
1976	Azinphosmethyl	77a[3/]	63a	23a
	Heavy fertilization	32b	25b	68b
	Check untreated	62a	38b	38b
1977	Carbofuran (disk)	69a	60a	31a
	Carbofuran (hand)	69a	53a	31a
	Check (caged)	60a	52a	40a
	Check (uncaged)	56a	41b	41a
1978	Carbofuran (disk)	12a	4a	88a
	Check (uncaged)	8a	5a	92a

1/ Based on a sample of six cones of each of two ramets from two clones and subjected to CAS analysis.

2/ For treatment dosage rates and schedules see Table 1.

3/ Means not followed by the same letter are significantly different from one another at the 5 percent level of confidence.

Sound Seeds/100 Conelets Tagged

The number of sound seeds per 100 conelets tagged was arrived at by multiplying percent cones survived for 21 months times the number of sound seeds per cone. The number of sound seeds per cone on the spray treatment in 1976 was 2.5 times the uncaged check; however, for the number of sound seeds per 100 conelets tagged, the spray treatment in 1976 had only 1.1 times the check (Table 7). The reason was attributed to loss of conelets in the dimethoate treatment in 1975. The number of sound seeds per 100 conelets tagged for the carbofuran treatment was 2.6 times the check in 1978.

SUMMARY AND DISCUSSION

Overall, very little increased seed yield was obtained from any of the treatments on loblolly pine at Stuart Orchard during this evaluation. Although there was a significant increase in the number of sound seeds per cone in 1976 with the azinphosmethyl treatment, a decrease in the number of surviving cones due to insects and the other causes negated much of the gain. The loss in conelets in 1975 when dimethoate was used accounted for much of the loss. Although the carbofuran treatment (1977) gave a significant gain (almost double the check) in the number of surviving cones for a two year period (1977-78), the cone crop was so low that the loblolly orchard was not treated with insecticides or harvested in 1978. Although the heavy fertilization treatment had significantly less conelet loss caused by coneworms than the check or dimethoate. treatment in 1975, results were not substantiated in 1976. Difference in soil moisture conditions between the two years could have accounted for this. When using preventative treatments as with monthly spray schedules or with systemic insecticide soil treatments there is no way at present to determine whether a treatment will increase seed production during a particular year. Some years there will be success and some years there will not. This depends on insect populations and/or the cone crop present. It is expected that if the cone crop is high and insect populations are high azinphosmethyl or carbofuran would markedly increase seed yields in seed orchards; therefore, it is felt that continued treatment is warranted despite the lack of increase in seed yield during the period of the evaluation.

Facts indicate the need for research in developing techniques for predicting insect population trends and determining economic threshholds of insect populations. With the developing of such techniques would come the use of fewer insecticide applications possibly with better control.

Table 7. Total seeds produced from 100 conelets tagged

Years	Treatment	Total numbers of sound seeds/100 conelets tagged (Percent surviving cones x number sound seeds/cone)	Potential no. of seeds/100 conelets	Percent of potential crop
1975-76	Dimethoate-azinphosmethyl	1,953 (31 x 63)	13,800	14
	Heavy fertilization	1,650 (66 x 25)	13,800	12
	Check (untreated)	1,748 (46 x 38)	13,800	13
1977-78	Carbofuran-1977 (untreated 1978)	224 (56 x 4)	13,800	2
	Check (untreated 1977-78)	85 (17 x 5)	13,800	1

RECOMMENDATIONS

1. Until timing techniques are developed so that sprays are coordinated with peaks in damage, the following spray schedule is suggested for Stuart Orchard: (1) Mid-March to early April or as soon as conelets are closed, (2) Mid-May and (3) late August.

2. If carbofuran granules can be incorporated into the soil, apply them in January or early February.

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PRECAUTIONARY STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key out of reach of children and animals and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid inhalation of pesticide sprays or dusts; wear protective clothing.

If your hands become contaminated with a pesticide, wash them immediately with soap and water. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove the clothing immediately and wash skin thoroughly. After handling or spraying pesticides, do not eat or drink until you have washed with soap and water.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicide from equipment, do not use the same equipment for insecticides or fungicides that you used for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary landfill dump, or crush and bury them in a level, isolated place.

NOTE: Some states have restrictions on the use of certain pesticides. Check your state and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Department of Agriculture, consult your county agent, state extension specialist or FPM to be sure the intended use is still registered. For further information or assistance, contact Forest Pest Management, Alexandria Field Office, Pineville, La., 71360, (Telephone: FTS 497-7280, or Commercial 318/473-7280).